Ecosystem Service Valuation for Regulatory Analysis

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NCEE

Regulatory Benefit-Cost Analysis

- Benefits and cost should be expressed in common terms whenever possible

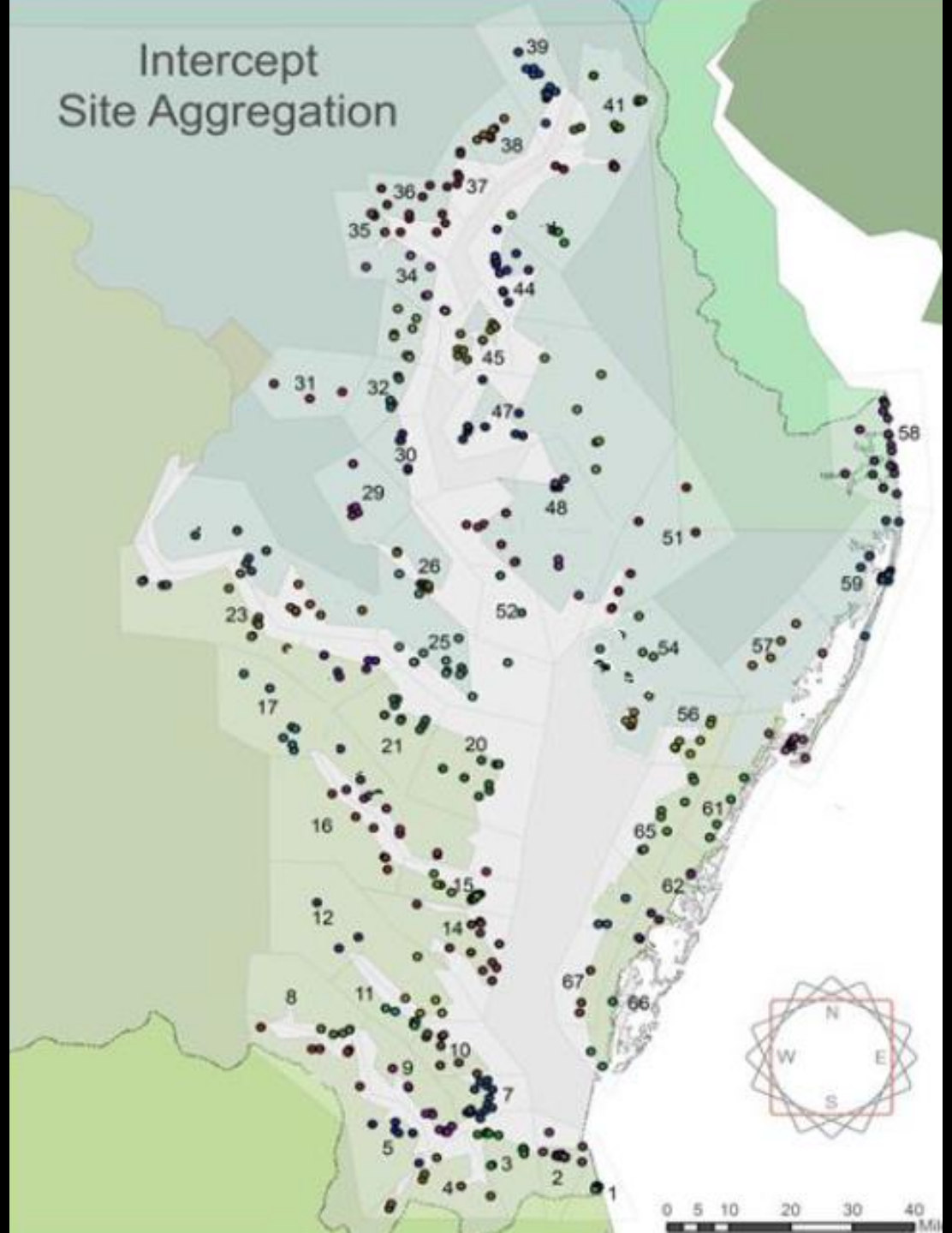
- We monetize benefits using *willingness to pay*

- Direct market impacts (e.g. commercial fishing)
  - Prices signal value
  - Need to use the correct value concepts, e.g. consumer and producer surplus

- Non-market impacts require valuation methods
  - Few policy impacts have prices determined in competitive markets
  - We have to either look for signals of value elsewhere *or* construct markets

Non-Market Valuation Methods

- Revealed Preference
  - Uses purchases of *complementary* goods and services to value environmental quality
  - Travel cost/recreation site choice



Travel Cost/Recreation Site Choice

- Collect data on trips to the Bay and similar sites

- Develop a probabilistic model of site choice based on
  - Distance/travel cost
  - Environmental quality
  - Other site characteristics
  - Demographics

- Random Utility Model
  - Compares the relative influence of variables on site choice
  - Infers value of non-monetary attributes

- Policy Analysis
  - Use results to estimate value of environmental changes to outdoor recreators

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  - Hedonic property value

Hedonic Property Value

- Uses data from home sales in 14 counties with Bay shoreline
- Model sales price as a function of
  - Distance from Bay
  - Water Quality
  - House characteristics
  - Neighborhood characteristics
- Use influence of water quality on sale price to estimate value to home owners

Non-Market Valuation Methods

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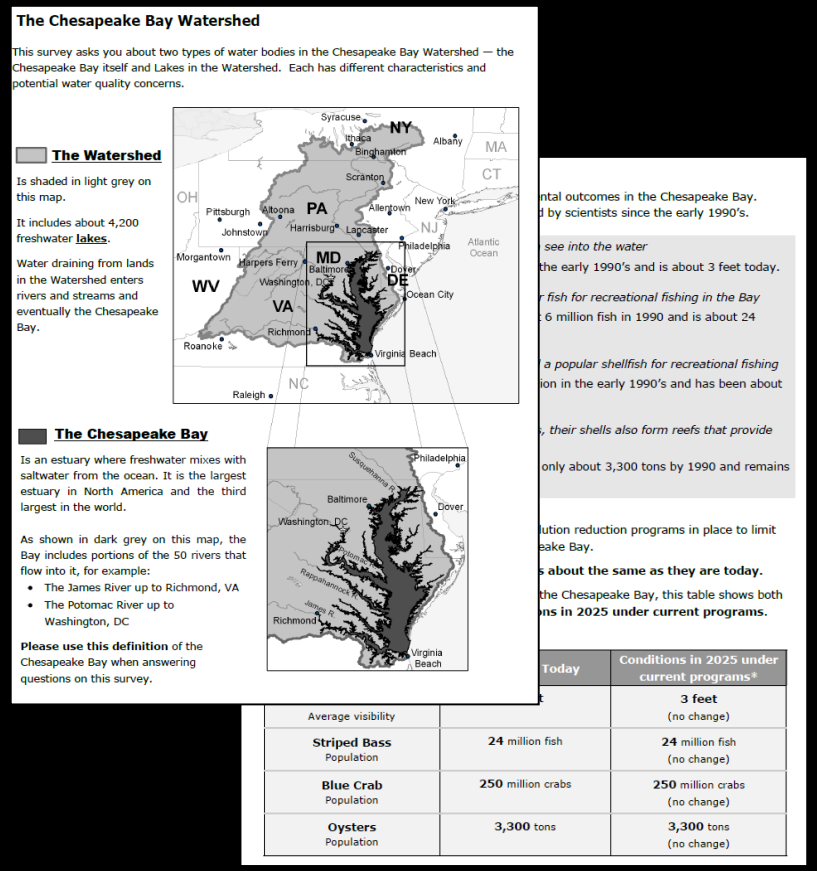
  - Travel cost/recreation site choice
  - Hedonic property value
  - Not all environmental values have complementary markets: non-use value

- Stated Preference
  - Uses surveys and questions about hypothetical tradeoffs to value environmental changes
  - Contingent valuation, choice experiments

Information Section



The Chesapeake Bay Watershed

This survey asks you about two types of water bodies in the Chesapeake Bay Watershed — the Chesapeake Bay itself and Lakes in the Watershed. Each has different characteristics and potential water quality concerns.

The Watershed

Is shaded in light grey on this map.

It includes about 4,200 freshwater **lakes**.

Water draining from lands in the Watershed enters rivers and streams and eventually the Chesapeake Bay.

The Chesapeake Bay

Is an estuary where freshwater mixes with saltwater from the ocean. It is the largest estuary in North America and the third largest in the world.

As shown in dark grey on this map, the Bay includes portions of the 50 rivers that flow into it, for example:

- The James River up to Richmond, VA
- The Potomac River up to Washington, DC

Please use this definition of the Chesapeake Bay when answering questions on this survey.

	Today	Conditions in 2025 under current programs*
Average visibility		**3 feet** (no change)
Striped Bass Population	**24** million fish	**24** million fish (no change)
Blue Crab Population	**250** million crabs	**250** million crabs (no change)
Oysters Population	**3,300** tons	**3,300** tons (no change)

Choice Experiment Question

10. Please vote for one of the three options below. *(Mark one box at the bottom to indicate which option you would prefer.)*

Environmental Outcomes	Conditions in 2025 (% change compared to today) Option A	Option B	Option C
Bay Water Clarity Average visibility	**3 feet** (no change)	**5 feet** (67% increase)	**5 feet** (67% increase)
Striped Bass Population	**24** million fish (no change)	**28** million fish (17% increase)	**24** million fish (no change)
Blue Crab Population	**250** million crabs (no change)	**280** million crabs (12% increase)	**312** million crabs (25% increase)
Oysters Population	**3,300** tons (no change)	**5,250** tons (59% increase)	**4,300** tons (30% increase)
Watershed Lakes Percent with low to moderate algae	**44** percent (no change)	**44** percent (no change)	**44** percent (no change)
Your Cost of Living Permanent cost increase for your household	**$0 every year**	**$180 every year** or $15 every month	**$60 every year** or $5 every month
Your Vote Please mark one of the boxes to the right	Option A ☐	Option B ☐	Option C ☐

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Similar to travel cost, comparing the relative importance of cost and water quality allows us to estimate willingness to pay.

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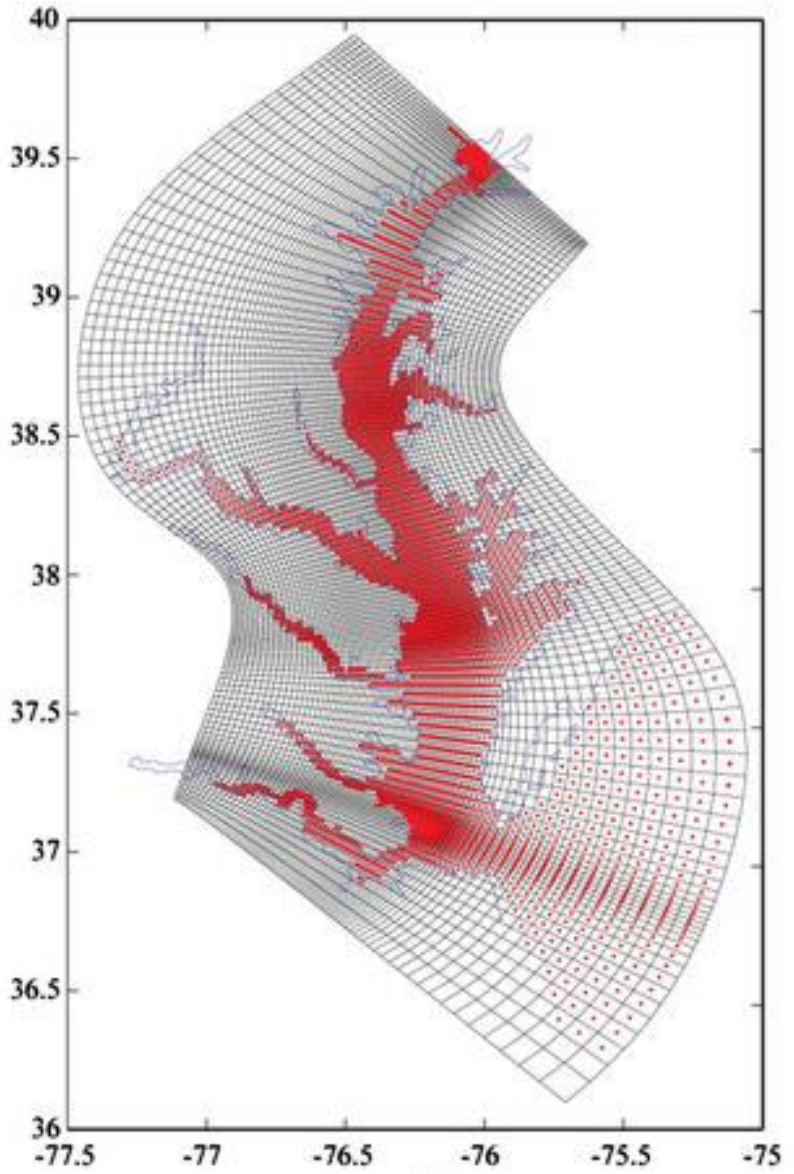
- A note on heath impacts
  - Cost of illness does not measure willingness to pay
  - Beach closures valued via travel cost and stated preference studies are generally used to value health risks

Defining Water Quality for Valuation

- Inputs - usually direct results of policy, e.g. nutrient loadings
- Endpoints - outcomes that people care about, e.g. water clarity, expected catch
- Ecological production functions - the processes by which inputs affect endpoints
- What we need to know depends on our valuation method
- Possible to estimate revealed preference models knowing inputs only
  - But if production functions vary over time and/or space our results will be biased
- Stated preference surveys should ask people about endpoints
  - When modelers rather than respondents link inputs to endpoints results will at least be consistent, if not correct.

Measuring vs. Modeling

- Policy analysis is both a retrospective and predictive exercise
- We need accurate measurements from the past to infer preferences from peoples' choices
- We also need accurate models to predict conditions in the future to estimate benefits
- Models are also needed when our measurement data are incomplete, e.g. spatial interpolation
- While most monitoring occurs in the Bay and its tributaries, modeling tends to rely on terrestrial data



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Published Results of the Chesapeake Study

Commercial Fishing

Moore, Chris, and Charles Griffiths. "Welfare analysis in a two-stage inverse demand model: an application to harvest changes in the Chesapeake Bay." *Empirical Economics*(2017): 1-26.

Hedonics

Walsh, Patrick, et al. "Modeling the property price impact of water quality in 14 Chesapeake Bay Counties." *Ecological Economics* 135 (2017): 103-113.

Recreation Demand (Ecological Modeling)

Massey, David M., et al. *Outdoor recreation benefits of water quality improvements in the Chesapeake Bay*. No. 201702. National Center for Environmental Economics, US Environmental Protection Agency, 2017.

Stated Preference

Moore, Chris, et al. "Valuing Ecological Improvements in the Chesapeake Bay and the Importance of Ancillary Benefits." *Journal of Benefit-Cost Analysis* 9.1 (2018): 1-26.